

Polio

Poliomyelitis is a disease few of us will ever see. The last case of polio in the United States occurred in 1979, and the disease now occurs only in a few countries in Africa and Asia. With our exclusive use of inactivated polio vaccine in the United States, vaccine associated polio no longer occurs in this country. We are going to limit our discussion to polio vaccine issues. There is information in your text about the epidemiology and clinical aspects of the disease. The polio chapter in your book begins on page 89.

Poliomyelitis is caused by an enterovirus. There are **three distinct serotypes of poliovirus: 1, 2, 3**. There is **minimal heterotypic immunity between serotypes**, which means that immunity to one serotype does not protect you very much from other serotypes. That is why there are three viruses in the vaccine. The **infection is acquired through the mouth**. The virus initially replicates in the pharynx and GI tract, then spreads to the lymphatics and other tissues, including the central nervous system. **Most poliovirus infections are asymptomatic**. However, between one in a hundred to one in a thousand infected persons develop permanent paralysis.

The paralysis caused by poliovirus is usually asymmetric, and sensory function is intact. People initially paralyzed may recover some or all motor function. Overall, from 2% to 5% of paralytic polio cases are fatal. In general, the severity of polio increases with age, and older children and adults are more likely to be paralyzed or die than infants.

This slide shows the number of reported cases of polio by year since 1950. Polio peaked in 1952, with more than 58 thousand total cases, and more than 21,000 paralytic cases, which are shown on this slide. The number of reported cases was falling, even before the introduction of the first polio vaccine in 1955. By the time oral polio vaccine was licensed in 1963, the number of cases was only a fraction of that reported in the prevaccination era. The last documented cases of paralysis caused by wild polio transmitted in the United States were in 1979. These cases were part of an outbreak among the Amish in the Midwest. The virus responsible for this outbreak had been imported from the Netherlands.

The elimination of indigenous transmission of wild poliovirus in the United States helped stimulate the development of a global polio eradication program. We will talk more about the global eradication program in a few minutes.

Even after the last case of paralysis from wild virus polio in 1979, cases of paralytic polio continued to be reported. This graph shows the number of paralytic polio cases reported in the United States by year since 1980. In this 24

year period, 158 paralytic cases were reported, an average of about 7 cases per year. Six of the 158 cases were acquired in other countries and imported into the U.S., and the cause of two cases was indeterminant. These 8 cases are shown in tan on the graph. The last imported case occurred in 1993. The remaining 150 cases, or 95% of all cases reported since 1980, were caused by polio VACCINE virus, shown in the green bars on the graph. In fact, EVERY case of paralytic polio acquired in the United States since 1980 was caused by vaccine virus.

Wild virus polio has been eliminated from the United States since at least 1980. Almost all of the paralytic polio reported in the United States since that time was caused by oral polio vaccine. The desire to eliminate ALL paralytic polio from this country is why the use of oral polio vaccine was discontinued in the United States. The last known case of vaccine associated paralytic polio in this country occurred in 1999.

It is amazing that so much progress has been made in eliminating polio in less than 50 years. The first polio vaccine was licensed in 1955. That was just after the peak of the last epidemic. Americans had been gripped by fear for themselves and their children for a decade. So the announcement by Jonas Salk of the success of the polio vaccine study, known as the Francis Field Trial, was a cause for major celebration. We found this newsreel from 1955 that gives you a flavor of the extraordinary excitement this discovery caused.

1955, A YEAR OF ANXIETY AND TRIUMPHS. A MAJOR MEDICAL HURDLE WAS CROSSED BY THE DISCOVERY OF THE ANTIPOLIO VACCINE, WHICH WAS TO SPREAD A MANTLE OF PROTECTION OVER MILLIONS OF AMERICAN CHILDREN. AND THE SCIENTIST ENTERED THE RANKS OF THE MEDICAL IMMORTALS. LEADING FIRMS SHIFTED INTO HIGH GEAR TO MEET A DEMAND, DESPITE EARLY CONTROVERSY. EACH HASTILY SET UP CENTER BECAME A MECCA FOR ANXIOUS PARENTS SHEPHERDING THE CHILDREN TO THEIR INOCULATIONS. THEY'RE PROTECTED; AND IT DIDN'T HURT A BIT.

Inactivated polio vaccine was licensed in 1955, and the demand for it was enormous. Millions of doses of Salk vaccine were administered in the late 1950s. Trivalent oral polio vaccine was licensed in **1963**. OPV rapidly became the polio vaccine of choice. An enhanced version of IPV was licensed in **1987**, and the original Salk IPV was taken off the market in 1988. Production and distribution of oral polio vaccine was discontinued in the United States in **2000**. Oral polio vaccine was responsible for the elimination of wild polio virus from the United States. OPV continues to be used extensively throughout the rest of the world, and will eventually be the vaccine that eliminates polio from the planet. But OPV no longer plays a role in polio vaccination policy in the United States. The remainder of our discussion will concentrate on the use of inactivated polio vaccine.

Enhanced IPV, which we will refer to as simply IPV, is an excellent vaccine that is **highly effective in producing immunity to poliovirus**. Like many other inactivated vaccines, most recipients do not become immune after a SINGLE dose. But **90% of recipients are immune to all three poliovirus types after 2 doses. 99% are immune after 3 doses.**

The schedule recommended by the ACIP, and the American Academies of Pediatrics and Family Physicians, is 4 doses of IPV, beginning at **2 months** of age. The first dose may be given as early as 6 weeks of age. The second dose should be given at **4 months** of age, and the third may be given as early as **6 months** of age. A fourth dose of IPV is recommended at school entry, at **4 to 6** years of age. If an accelerated schedule is needed, the minimum interval between all doses of IPV in the series is 4 weeks. Although it is preferable to administer the fourth dose at school entry, it may be given earlier and be counted as a valid dose. And of course, IPV may be given simultaneously with all other childhood vaccines.

Children who received three doses of either OPV or IPV before the fourth birthday should receive a fourth dose of polio vaccine at the time of school entry. But if the third dose was given on or after the fourth birthday, a fourth dose is not required. However, this rule applies **ONLY** to children whose first three doses were either **ALL OPV** or **ALL IPV**. If the child received any combination of **BOTH OPV and IPV**, then a total of 4 doses are recommended, regardless of the age when the third dose was given.

A related issue is that of children who received OPV for their early doses and are now due for their school entry dose. We have gotten many calls and Emails with questions about how many doses to administer in this situation. **Remember that IPV is the only polio vaccine available in the United States.** So children who began their series with OPV should receive IPV to complete it. **Any combination of 4 doses of IPV and OPV by 4 to 6 years of age constitutes a complete series.** You do NOT need to add any extra doses. Four **TOTAL** doses are all that is needed.

We want to make sure you are clear on this point. A total of **FOUR** doses is recommended if a child received **ANY** combination of IPV and OPV. This recommendation is for all children through 18 years of age. The only situation in which **THREE** doses are acceptable is when all three doses are the same type of vaccine, and one or more of those doses was administered on or after the fourth birthday.

Polio vaccination of adults does generate a lot of questions, mostly from international travelers and travel health providers. **ROUTINE polio vaccination of U.S. residents 18 years of age and older is neither necessary nor recommended.** The only adults for whom vaccination **should be considered** are those who **travel to polio endemic areas of the world, and selected laboratory workers** who may come into contact with wild polio viruses. Endemic areas currently exist only in Africa and Asia.

Unvaccinated adults, including those who cannot document prior vaccination, should receive 3 doses of IPV, each separated by at least 4 weeks. If travel is imminent – less than 4 weeks – an unvaccinated person should receive a single dose of IPV. The remaining doses of the series should be administered later if the person remains at risk. People with a documented incomplete series should receive the remaining doses of the series. It is not necessary to restart or add doses to the series because of a lapse in the series. Adults who can document a complete series of any type of polio vaccine in the past should receive a single booster dose of IPV. This booster dose is only given once in an adult's lifetime.

Inactivated polio vaccine is one of, if not THE safest vaccine available. As with any injected vaccine, **local reactions** at the site of injection of IPV may occur, but they are not common. **Severe adverse reactions are rare**, and are mostly allergic reactions. In the past, almost all adverse reactions following polio vaccine were due to ORAL polio vaccine. Vaccine associated paralytic polio was a rare occurrence, but it led to the discontinuation of use of OPV in the United States. Details about vaccine associated paralytic polio can be found in the course text.

Contraindications and precautions to inactivated polio vaccine are also very limited. As with all vaccines, a **severe allergic reaction to a component or following a prior dose is a contraindication to IPV. Moderate or severe acute illness is a precaution**, and vaccination should be deferred until the person's condition improves. Pregnancy is not a contraindication to the use of IPV. But since routine polio vaccination of Americans 18 years and older is not recommended, pregnancy will not be a common issue, except for those of you who see travelers.

It is likely that in the near future polio will become the second virus intentionally eradicated from the planet. The **last known case of paralytic disease caused by wild polio virus in the United States occurred in 1979**. The Pan American Health Organization devised an aggressive – and successful – OPV mass vaccination program in 1985. The **last case of wild virus polio in the entire western hemisphere occurred in Peru in 1991**. Due largely to the success of the polio elimination program in the Americas, the World Health Organization established a polio eradication program in 1988. Its goal: **global eradication of poliovirus by the end of the year 2005**. This map shows in red the countries with poliovirus transmission in 1988, the year the global eradication program began. That year, more than 350 thousand cases occurred in at least 125 countries, including much of central and south America, parts of Europe, all of Africa and most of Asia. In 2003, a total of only 677 cases of polio were reported from 6 countries. These countries, shown on this map in red are located in 3 WHO regions – Africa, Eastern Mediterranean, and South East Asia. Nigeria accounted for almost half of all cases. It appears that one type of wild poliovirus has already been eradicated. The last known case of polio caused by type 2 virus occurred in India in October 1999. Another major milestone was achieved in June 2002 when the European region was certified as free of indigenous wild poliovirus transmission. The European region includes 51 countries, from

western Europe through the countries of the former Soviet Union, and has a population of 870 million. An estimated 3.4 billion people, or 55% of the world's population, now live in countries and territories certified free of endemic wild poliovirus transmission. Several challenges to global eradication remain. Among them: **maintaining high-quality surveillance and immunization activities; gaining access to children in conflict affected countries; providing sufficient oral polio vaccine; and ensuring political and financial support until certification of global eradication is achieved in 2005.** You may be able to help meet at least one of these challenges. CDC continues to recruit healthcare professionals for short-term field assignments to polio endemic countries. This program is called Stop Transmission of Polio, or STOP. Here is Virginia Swezy, the STOP Activity Team Leader, to tell you about it.

Swezy: *The global program for polio eradication began following a World Health Assembly resolution in 1988, when Ministries of Health of all countries resolved to eliminate this terrible disease. In partnership with Ministries of Health, this effort is led by the World Health Organization, UNICEF, Rotary International and the Centers for Disease Control and Prevention.*

Over the years, CDC has provided technical expertise to the partnership of WHO, UNICEF and to individual countries, especially in epidemiology, surveillance and laboratory science. The Stop Transmission of Polio, or STOP program is an effort to provide human resources for the polio eradication effort. The global polio eradication initiative is now in its final phase. But the challenges that remain are the most difficult ones.

In 1998, CDC initiated the STOP team program. It's objective is to accelerate the progress of the polio eradication program. The STOP Program deploys teams of public health professionals to provide field support where it is needed most. Teams collaborate with national counterparts from the Ministry of Health, WHO and UNICEF in support of the strategies.

In 1999, the first group of 25 STOP team members were assigned to 5 countries: Bangladesh, Yemen, Burkina Faso, Nepal and Nigeria. Since that time, 13 STOP teams, comprising of nearly 500 health professionals, have been assigned to 42 different countries. In 2002, based on the expressed needs of a number of countries, the STOP program expanded beyond polio to include data management support at the national level, as well as measles mortality reduction activities in a few countries.

The duties of the team members vary depending on the needs of the country of assignment and the skills of the STOP team member. Once in country, team members are typically assigned to different districts and must work independently. Over the course of the 3 month assignment, team members may conduct and evaluate active surveillance; assist with case investigations and follow-up as well as conduct measles outbreak investigations; help with planning, implementing and evaluating supplemental immunization activities such as national immunization days; and develop and strengthen data management systems for the national immunization programs.

Each day is different for team members. They may work with local religious leaders to overcome rumors about the safety of the vaccines, train traditional healers about surveillance, travel to a remote island to investigate a suspected case, or give a presentation to health officials on immunization campaign coverage.

So who makes up the STOP teams? And what qualifications are we looking for? STOP team members come from diverse backgrounds. They are qualified public health professionals from all over the world. The common link between all STOP team members is an appreciation and understanding of public health, surveillance and epidemiology.

This mission can be quite difficult. Team members are assigned to polio endemic countries, often the poorest countries in the world. Once there, team members will travel to the highest risk areas to conduct surveillance, investigate cases and participate in vaccination activities.

Those who accept to go on this mission have strong professional expertise as well as the ability to work comfortably outside of one's own culture. Imperative to the success of a mission is the ability to work well with those of a different culture and the ability to work in difficult climates. Team members are expected to live at the district level, which may lack medical facilities, familiar food or comfortable accommodations.

A STOP team assignment isn't for everyone. But it can be a very rewarding experience. If you are interested and would like additional information please contact us. This could be your opportunity to participate in one of the greatest achievements of medical history, the eradication of polio virus from the earth.

If you would like more information about becoming a volunteer for the STOP program, additional information regarding assignments, qualifications, the application process are available on the National Immunization Program website. We will include a link to this information from our broadcast resources web page.